WHAT IS CLAIMED IS:

1. A variable optical delay (VOD) system comprising:

a liquid crystal optical switching subsystem for imparting a delay on an optical signal.

2. The VOD system as in claim 1, wherein a fine delay is imparted on the optical signal.

3. The VOD system as in claim 2, wherein the fine delay is in the range of about 1 fs to about 100 fs.

4. The VOD system as in claim 1, wherein the liquid crystal optical switching subsystem comprises a liquid crystal cell having opposing electrodes and liquid crystal material between said opposing electrodes.

5. The VOD system as in claim 4, wherein the liquid crystal switching subsystem is switchable between an electric-field Off position and electric-field On position, further wherein a refractive index change occurs in a liquid crystal cell.

6. The VOD system as in claim 1, wherein the delay imparted is determined by a liquid crystal cell gap L, a liquid crystal birefringence Δn, and an electrical potential V.

7. The VOD system as in claim 4, wherein the liquid crystal material comprises a liquid crystal material capable of providing electrically controlled birefringence.

8. A VOD system comprising a refractive index switching system wherein upon passage of an optical signal through the index switching system, a delay is varied by the selected fluid within the region.

9. The VOD system as in claim 8, wherein one or more regions capable of having at least 2 different fluids exchanged therein are provided.

10. The VOD system as in claim 9, wherein the at least 2 different fluids comprise air and a refractive fluid.

11. The VOD system as in claim 9, wherein the region dimensions are essentially constant.

12. The VOD system as in claim 10, wherein a medium delay is imparted on the optical signal.

13. The VOD system as in claim 12, wherein the medium delay is about 100 fs to about 10 ps.

14. The VOD system as in claim 8, wherein an optical path length is varied by introducing or evacuating either air or liquid material along the optical signal travel path.

15. The VOD system as in claim 14, wherein the introduction and/or evacuating is into the predefined gaps.

16. The VOD system as in claim 15, wherein the introduction and/or evacuating is performed with micro-pumps, or micro-fluidic actuators.

17. The VOD system as in claim 15, wherein the micro-fluidic actuators may comprise electro-static actuator, electro-magnetic actuator, electro-thermal actuator, or any other MEMS actuators.

18. The VOD system as in claim 9, wherein at least one of the at least 2 different fluids comprises a refractive fluid.

19. The VOD system as in claim 18, wherein the refractive fluid may comprise any chemically stable liquid compounds capable of providing a refractive index value greater than the other fluid.

20. A VOD system comprising optical manifolds including polarization optical switches, liquid crystal optical switches or TIR elements arranged in a folded path to allow optical signal pass-through or delay, the delay being based on the folded path length.

21. The VOD system as in claim 20, wherein the folded path is extended by serial

liquid crystal optical switches or TIR elements.

22. The VOD system as in claim 20, wherein a coarse delay is imparted on the optical signal.

23. The VOD system as in claim 22, wherein the coarse delay is about 10 ps to about 1 ns.

24. The VOD system as in claim 20, wherein multiple folds are provided.

25. The VOD system as in claim 24, wherein multiple folds comprise single folds stacked on top of each other.

26. The VOD system as in claim 24, wherein multiple folds comprise a single monolithic block of molded manifold

27. A VOD system comprising optical manifolds including index switching systems, wherein regions capable of having at least 2 different fluids exchanged therein are arranged in a folded path to allow pass-through or delay depending on the choice of fluid in the region, the delay being based on the folded path length.

28. The VOD system as in claim 27, wherein the folded path is extended by serial regions capable of having at least 2 different fluids exchanged therein.

29. The VOD system as in claim 27, wherein a coarse delay is imparted on the optical signal.

30. The VOD system as in claim 29, wherein the coarse delay is about 10 ps to about 1 ns.

31. The VOD system as in claim 27, wherein multiple folds are provided.

32. The VOD system as in claim 31, wherein multiple folds comprise single folds stacked on top of each other.

33. The VOD system as in claim 31, wherein multiple folds comprise a single monolithic block of molded manifold

34. A variable optical delay (VOD) system comprising:

an optical switching subsystem; and

an optical manifold subsystem.

35. The VOD as in claim 34, further comprising a variable fluid refraction altering subsystem.

36. The VOD as in claim 34, wherein the optical switching subsystem comprises a liquid crystal cell.

37. The VOD as in claim 34, wherein the optical manifold subsystem comprises a plurality of polarization switches having variable optical paths, wherein at least one optical route comprises a folded path.

38. The VOD as in claim 37, wherein the polarization switches comprise liquid crystal cells.

39. The VOD as in claim 34, wherein the optical manifold subsystem comprises a plurality of total internal reflection switches having variable optical paths, wherein at least one optical route comprises a folded path.

40. The VOD as in claim 35, wherein the variable fluid refraction altering subsystem comprises at least one micro-fluidic actuator.

41. The VOD as in claim 40, wherein the variable fluid refraction altering subsystem comprises a fluid region having a first fluid with a first refractive index, further wherein the micro-fluidic actuator injects a second fluid with a second refractive index.

42. The VOD as in claim 41, wherein the first fluid comprises air.

43. The VOD as in claim 40, wherein the variable fluid refraction altering subsystem comprises a first fluid region having a quantity of a first fluid with a first refractive index and a second fluid region having a quantity of the first fluid, further wherein the micro-fluidic actuator injects a second fluid with a second refractive index into the first fluid region or the second fluid region.

44. The VOD as in claim 43, wherein the first fluid comprises air.